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PROCEDURE FOR THE DETERMINATION OF ODOR ON OHIO RIVER STUDY

Environmental Health Center
Cincinnati, Ohio

July 1950

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I. General:

Taste and odor problems have been of increasing concern to the consumer, the water plant operator and others in the field of water supply. The Ohio River Valley Water Sanitation Commission has requested that steps be taken to evaluate the problem as it relates to the Ohio River and certain tributaries.

A sampling and testing program for odor determination is being undertaken by seventeen water plants located at various places in the Ohio River Valley. The Environmental Health Center is assisting with certain phases of the program, principally the establishment of standard procedures for making odor tests.

The water dilution method of odor testing is subject to certain inherent errors due to the nature of the test and the fact that we must rely on the sense of smell for the results. In order to compare one observer with another and to determine the sensitivity of a single observer from day to day, tests are to be made with a standard odor substance. Several compounds were carefully tested in the Environmental Health Center laboratory and normal butyl alcohol was selected as the standard for use in this study.

It is desirable, at least at the beginning of this study, to run a test on the standard substance each time an odor determination is made.

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Odor tests should be made daily except Saturday and Sunday. If daily tests can not be made, a series on Monday, Wednesday and Friday of each week would be satisfactory.

It is requested that copies of the observations made on odor tests be forwarded to the Environmental Health Center every two weeks. Forms for the recording of the data and franked self-addressed envelopes for mailing are provided.

The procedure which follows is to serve as a guide particularly to plants not now making odor observations. If procedures now in use do not deviate from standard methods or are otherwise acceptable they may be used in lieu of the procedure presented.

II. Reagents and Apparatus:

1. n-butyl alcohol is the standard odor substance to be used. This chemical will be furnished by the Environmental Health Center. The odor in the dilutions used is sweetish in nature.

2. Odor-free Tap Water: Percolate tap water through granular activated carbon at a rate of less than 5 gallons per hour. Two one-gallon jugs connected in series with the inlet of each going to the bottom may be used as a percolation train. The jugs are packed with granular activated carbon held in place by a layer of glass wool on top. An alternate method is to add 10 grams of activated carbon to 5 gallons tap water. Agitate at frequent intervals for the first two hours and then let stand several hours or over night. Filter through glass wool into an odor-free container. Filter paper will often impart odor to water. Avoid contact of the water with long lengths of rubber tubing. Test the first portion of the water filtered for residual chlorine. If chlorine is present, add more carbon or allow a longer contact time of water and carbon until no test for chlorine is obtained. The filtered water should be used immediately. The preparation of a suitable odor-free water can not be

over stressed as poor water will invalidate the results.

3. Two dozen 500 ml. glass-stoppered Erlenmeyer flasks.

4. Chemical thermometer (0-110°C.)

5. Graduates - 25 ml., 50 ml., 100 ml. and 200 ml., Pipettes, measuring 1 ml., 5 ml., 10 ml., six of each.

6. Glass wool for filtering

7. Glass funnels

8. Activated carbon

III. Washing Glassware:

It is preferable to use the required glassware only for odor testing and not for other laboratory purposes. Washing is best accomplished by use of acid cleaning solution* followed by several rinses. Final rinses should be made with odor-free water. Soaps are not generally good and some alkaline detergents may etch the glassware making thorough cleaning difficult. Before preparing the dilutions, test the odor-free water by taking a clean flask and adding 200 ml. of odor-free water. Shake and note whether or not odor is present.

IV. Procedure:

1. Preparation of Standard Odor Substances:

Tests have indicated that most observers will have a threshold, that is, they will first be able to detect n-butyl alcohol somewhere in the range of 1/16 to 4 p.p.m. To prepare these ranges, make dilutions as follows:

*Make 500 ml. of a saturated solution of potassium dichromate. Slowly add 800 ml. of concentrated sulfuric acid.

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a. Dilute exactly 0.5 ml. of pure n-butyl alcohol to 405 ml. with odor-free water. This solution contains 1000 p.p.m. butyl alcohol and may be used for two weeks.

b. Dilute 3.0 ml. of the 1000 p.p.m. solution prepared in (a) to 300 ml. with odor-free water. This solution contains 10 p.p.m. of the standard alcohol and should be made daily.

c. To obtain the desired range of concentration dilute the 10 p.p.m. solution as follows, letting each dilution be twice the preceding dilution:

p.p.m. Butyl Alcohol	1/16	1/8	1/4	1/2	1	2	4
ml. of 10 p.p.m. solution diluted to 200 ml. with odor-free water	1.2	2.5	5	10	20	40	80

2. Dilutions of raw and finished water may be prepared by starting with a 200 ml. sample and diluting over a range known to be wide enough to obtain the threshold.

Example

Dilution Number	1	2	3	4	5	6	7	8
ml. of sample diluted to 200 ml. with odor-free water	1.5	3.0	6.0	12.5	25	50	100	200

Other ranges or dilution intervals may be satisfactory.

3. It is desirable to have one individual prepare the dilutions and present them to the observer without identification. Blanks consisting of odor-free water only should be placed at random

in the series being tested. This should be done on the standard odor substance as well as the water samples. Testing should be in order from the most dilute to the least dilute to avoid tiring the sense of smell. If the observer detects odor, it is recorded as plus or if odor is absent it is recorded with a minus sign. It is well to smell a blank between each flask to refresh the sense of smell. Each sample should be agitated the same amount. A form is provided for recording the data (See sample of completed form).

If one person only must make dilutions and also observe he should devise some method to avoid the auto-suggestion likely to occur by a knowledge of samples and their concentrations. Suggested methods include coding of the bottles, then mixing the order of arrangement and taking the test blindfolded. Some observers have used a revolving wheel which is so arranged that code numbers are not visible on the flask. The observations are then made and the samples declared positive or negative.

4. All samples should be at 30°C. plus or minus one degree.

5. Other Precautions:

a. The hands of the observer and diluter must be thoroughly cleaned prior to the test. Flasks should be handled by the base.

b. Interfering odors should be absent from the room where tests are made.

c. Smoking just prior to making a test may interfere with the sense of smell. It is probably better not to smoke just before making the test.

d. A short rest between samples is desirable.

SAMPLE OF COMPLETED REPORT FORM

City Middletown Observer J. Doe

Date 7/3/50 Diluter B. Roe

Time 10:00 A.M. Temperature 30° C.

Dilution Number	Concentration of Standard (p.p.m.)	Observer's Reaction (+or-)	Ml. of Raw Water Diluted to 200 ml.	O.R. (+or-)	Ml. of Finished Water Diluted to 200 ml.	O.R. (+or-)
1	1/16	-	3.0	-	12.5	-
2	1/8	-	6.4	-	25	-
3	Blank	-	12.5	-	-	-
4	1/4	+	Blank	-	50	-
5	1/2	+	25	+	100	+
6	Blank	-	50	+	200	+
7	1	+	Blank	-		
8	2	+	100	+		
9	4	+	200	+		
10	-					

Remarks: River at abnormally high stage due to recent rains.

Observer suffering from bad cold.

Type of Odor: Musty etc.